

PATENT ABSTRACTS OF JAPAN

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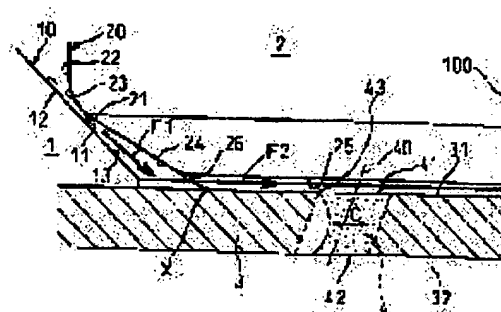
KOGA NOBUHIKO

(54) FUEL INJECTION VALVE

(57)Abstract:

PROBLEM TO BE SOLVED: To improve atomization of fuel by making it easy to peel fuel at an inlet of a nozzle hole and promoting self-excited oscillation of a liquid column and a liquid film of fuel by connecting a seal part of a needle valve and a bottom surface on the lowest downstream side to each other through a specific intermediate surface forming a fuel channel inclined to the inside downstream.

SOLUTION: Fuel flows in the F1 direction in a fuel channel formed and inclined between a downstream side part 13 of a valve body 1 and an intermediate surface 24 of the downstream side of a needle valve 2 after passing a clearance between each of seal parts 11, 21 of the valve body 1 and the needle valve 2 at the time of opening the needle valve 2. This intermediate surface 24 is formed so that a cross line (x) formed by crossing with a surface on the upstream side of a measuring member 3 comes to be on the outside of a circumscribed circle of an inlet opening part 41 of a nozzle hole 4. Consequently, at the time when fuel is jet out from a nozzle hole 4 fuel is properly peeled at the time of flowing into the nozzle hole 4, a vortex grows in a flow of fuel immediately after an inlet of the nozzle hole 4, 5 liquid column and a liquid film of injection fuel are self-excited oscillated, and the fuel is properly atomized.



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CLAIMS

[Claim(s)]

[Claim 1] The bulb body and the needle valve which are received inside said bulb body, and open and close the passage of a fuel in the seal section, In the fuel injection valve possessing the metering zone material which is arranged by the point of said bulb body, has two or more nozzle holes, and performs measuring of a fuel, and decision of the injection direction It is formed so that the internal surface of the seal section lower stream of a river of said bulb body may follow the field of the upstream of said metering zone material gently. The seal section of said needle valve, and the base by the side of the lowest style Have two incomes with the internal surface of the seal section lower stream of a river of said bulb body at the time of needle valve valve opening, and it is connected through the interface which forms the fuel passage which inclined on the inside lower stream of a river which introduces a fuel into the nozzle hole arranged in said metering zone material. Said interface of said needle valve is set at the time of needle valve valve opening. The fuel injection valve characterized by being formed so that the nodal line formed by intersecting the field of the upstream of said metering zone material may become outside the circumscribed circle of upstream opening of the nozzle hole arranged in said metering zone material, when itself is turned to the field of the upstream of said metering zone material and is extended.

[Claim 2] The fuel injection valve according to claim 1 characterized by making said interface of said needle valve into a conical-surface configuration.

[Claim 3] The fuel injection valve according to claim 1 characterized by making said interface of said needle valve into a spherical-surface configuration.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]

[Field of the Invention] This invention arranges a fuel injection valve and the metering zone material which has a nozzle hole in the point of the bulb body especially, and relates to the fuel injection valve of the format of performing measuring of a fuel, and decision of the injection direction, by injecting a fuel from this nozzle hole.

[0002]

[Description of the Prior Art] The fuel injection valve of the type which performs measuring of a fuel and decision of the injection direction is well-known by arranging the metering zone material which has two or more nozzle holes in the fuel regurgitation path outlet formed in the point of the bulb body, and injecting a fuel from this nozzle hole (refer to JP,3-92564,U and JP,3-104166,U).

[0003]

[Problem(s) to be Solved by the Invention] Although attenuation of the kinetic energy which the fuel has is controlled in the fuel injection valve of the above-mentioned official report since the fuel which passed the seal section of the needle valve which generally opens and closes the passage of a fuel is considered as the configuration led to a nozzle hole as it is, a fuel enters a combustion chamber in the state of a liquid column and liquid membrane at reverse, and there is a problem that atomization of a fuel is not fully performed. Then, an applicant for this patent sets to Japanese Patent Application No. No. 078920 [seven to] submitted previously. Prepare the projection which attends a fuel regurgitation path at the head of said needle valve, and it constitutes so that the extension wire of the periphery of this projection may become the outside of the circumscribed circle of the nozzle hole of metering zone material. Make it flow toward metering zone material first, after hitting metering zone material, meet metering zone material, and make the fuel which passed the seal section go in the direction of a core, and it is made for a fuel to tend to exfoliate at a nozzle hole inlet port. The fuel injection valve constituted so that the liquid column of a fuel and the self-excited vibration of liquid membrane might be activated and the atomization of a fuel might be promoted is proposed. However, since the strong fuel of the flow of a lengthwise direction was rapidly changed into lateral flow, in a configuration like the above-mentioned application, attenuation of kinetic energy was large, and exfoliation of a fuel was not fully carried out to it at a nozzle hole inlet port, but the fuel which passed the seal section had the trouble that kinetic energy of a fuel could not be effectively used for atomization in it. In view of the above-mentioned problem, this invention controls attenuation of the kinetic energy of a fuel in the fuel injection valve which arranged the metering zone material which has a nozzle hole in the point of the bulb body, and it is made easy to exfoliate the flow of the fuel in a nozzle hole inlet port, and it aims at improving the atomization of a fuel.

[0004]

[Means for Solving the Problem] The needle valve is received inside the bulb body and said bulb body, and open [according to this invention] and close the passage of a fuel in the seal section in order to attain the above-mentioned object, In the fuel injection valve possessing the metering zone material which is arranged by the point of said bulb body, has two or more nozzle holes, and performs measuring of a fuel, and decision of the injection direction It is formed so that the internal surface of the seal section lower stream of a river of said bulb body may follow the field of the upstream of said metering zone material gently. The seal section of said needle valve, and the base by the side of the lowest style Have two incomes with the internal surface of the seal section lower stream of a river of said bulb body at the time of needle valve valve opening, and it is connected through the interface which forms the fuel passage which inclined on the inside lower stream of a river which introduces a fuel into the nozzle hole arranged in said metering zone material. Said interface of said needle valve is set at the time of needle valve valve opening. When itself is turned to the field of the upstream of said metering zone material and is extended, the fuel injection valve characterized by being

formed so that the nodal line formed by intersecting the field of the upstream of said metering zone material may become outside the circumscribed circle of upstream opening of the nozzle hole arranged in said metering zone material is offered. Moreover, said interface of a needle valve is made into a conical-surface configuration or a spherical-surface configuration.

[0005] Since the fuel injection valve of this invention is constituted as mentioned above, at the time of needle valve valve opening A fuel passes along the fuel passage which inclined from the clearance between the seal sections on said inside lower stream of a river formed between said interface of the needle valve of the downstream, and the internal surface of the bulb body. It flows aslant toward a valve core, and it flows, exfoliating in the arranged nozzle hole at the entrance while flowing in a longitudinal direction toward a valve core through between the base by the side of the lowest style of a needle valve, and the fields of the upstream of metering zone material, and resulting focusing on a valve, if metering zone material is hit, and is discharged from an outlet.

[0006]

[Embodiment of the Invention] The gestalt of operation of this invention is explained using an accompanying drawing below. Drawing 1 is the sectional view showing the structure of the gestalt of operation of the 1st of the fuel injection valve by this invention, a needle valve 2 is received inside the bulb body 1, and the metering zone material 3 is attached in the edge of the downstream of the bulb body 1, and the metering zone material 3 has two or more nozzle holes 4.

[0007] Drawing 2 is drawing having expanded and shown the part of A of drawing 1, and shows the condition in case a fuel is injected. In drawing 2, 10 shows the whole internal surface of the bulb body 1, 20 shows the whole external wall surface of a needle valve 2, and it is the seal section of the bulb body 1, and the seal section of a needle valve 2, and 11 and 21 contact mutually the period which does not inject a fuel, and intercept the flow of a fuel.

[0008] The internal surface 10 of the bulb body 1 is applied to the part 13 of the downstream from the part 12 of the upstream of the part of the seal section 11, and uniformly, it is formed so that the medial axis 100 of a fuel injection valve may be approached, as it goes to the downstream. In addition, among drawing, although the part parallel to a medial axis 100 is shown between the bulb body 1 and the metering zone material 4, this is made, when processing the bulb body 1.

[0009] From the part 22 almost parallel to a medial axis 100, through the curved-surface section 23, the external wall surface 20 of a needle valve 2 reached the seal section 21, and has arrived at the base 25 in the downstream of the seal section 21 through the bay 24 which is the interface made into the conical-surface configuration at the upstream of the seal section 21. It is smoothly connected by the curved-surface section 26 between the bay 24 and the base 25.

Moreover, the base 25 is formed in the right angle to the medial axis 100.

[0010] The top face 31 and underside 32 of the metering zone material 3 are formed in the right angle to the medial axis 100, respectively. Therefore, the top face 31 of the metering zone material 3 and the base 25 of a needle valve 2 are parallel. If a nozzle hole 4 extends the medial axis 40 to the upstream, it is formed so that a medial axis 100 may be crossed, and the entrance-side opening 41 is located inside the outlet side opening 42. Here, the point X that the line which extended the bay 24 of the downstream of the seal section 21 of the external wall surface 20 of a needle valve 2 to the downstream crosses the top face 31 of the metering zone material 3 is in the appearance illustrated outside the outermost edge 43 of the entrance-side opening 41 of the nozzle hole 4 of the metering zone material 3.

[0011] Drawing 3 is drawing seen along with the I-I line of drawing 1, 33 expresses the circle which connected the point X that the line which extended the bay 24 of the downstream of the seal section 21 of the outside surface 20 of a needle valve 2 to the downstream crossed the top face 31 of the metering zone material 3, and 46 expresses the circumscribed circle which connected the outermost edge 43 of the entrance-side opening 41 of a nozzle hole 4.

[0012] Next, it explains that the fuel in the gestalt of operation of this invention formed as mentioned above flows. After a fuel passes along the clearance between the seal section 11 of the bulb body 1, and the seal section 21 of a needle valve 2 at the time of needle valve valve opening, the fuel passage which inclined on the inside lower stream of a river formed between the downstream part 13 of the bulb body 1 and the bay 24 of the downstream of a needle valve 2 is flowed to the appearance shown by the arrow head F1 of drawing 2. And after colliding with the top face 31 of the metering zone material 3, an arrow head F2 is met in between the top face 31 of the metering zone material 3, and the bases 25 of a needle valve 2, and it flows toward the direction of a medial axis 100.

[0013] Then, although it flows into a nozzle hole 4 from the entrance-side opening 41, it becomes a liquid column and liquid membrane from the outlet opening 42 and it is discharged Since it exfoliates in the entrance-side opening 41 when flowing into a nozzle hole 4, width of face changes in the direction of the arrow head C of drawing 2, the liquid column of the fuel discharged and liquid membrane carry out self-excited vibration of the fuel which a periodic eddy occurs with the flow of a fuel in an immediately after [an inlet port] style part, consequently passes through the interior of a nozzle hole 4, and a fuel is atomized.

[0014] There is nothing fuels are first indicated to be to an arrow head F1 by the downstream of the seal section as mentioned above by this invention here, that it flows like and is shown in an arrow head F2 below and in which a fuel loses kinetic energy greatly by this directional change since that include angle is not large, although the sense is changed like. Therefore, since it has comparatively big kinetic energy also when the entrance-side opening 41 of a nozzle hole 4 is reached, a fuel tends to exfoliate from the outermost edge 43 of the entrance-side opening 41. Consequently, a strong eddy occurs, the self-excited vibration of a liquid column and liquid membrane becomes strong, and the atomization of a fuel is good.

[0015] What is shown in drawing 4 is drawing showing the structure of the 2nd operation gestalt of this invention, and, unlike the 1st operation gestalt, the point of other parts, i.e., the point that the interface is made into the spherical-surface configuration, that the cross section of the interface which connects the seal section 21 and the base 25 of a needle valve 2 is connected with the circle of the radius R centering on a point 200 is the same. And he is trying to locate in the outside of the outermost edge 43 of the entrance-side opening 41 of a nozzle hole 4 point X' at which the tangent 29 with which this circle passes along the point 28 of crossing a base 25 crosses the top face 31 of the metering zone material 3. Although it flows almost like the 1st operation gestalt to F1 in drawing', and the appearance shown by F2' and the same effectiveness is shown, since the deflection of down-stream flow becomes smoother from the seal section, the attenuation of kinetic energy of a fuel is small, and since the outermost edge 43 of the part and the entrance-side opening 41 of a nozzle hole 4 to exfoliation becomes good, the atomization of a fuel becomes still better. Moreover, the dead volume at the time of clausilium becomes small, and it remains in the downstream of the seal section at the time of needle valve clausilium, and after that, since the amount of the fuel attracted with inhalation negative pressure decreases, the precision of the amount of the fuel inhaled improves.

[0016] In addition, it can be made the shape of the spherical surface, or can be made the shape of a cone, or it is possible that deforming variously is also possible, for example, it makes the base 25 of the needle valve 2 in the gestalt of each operation mentioned above the shape of a concave surface etc. What made the base 25 of the needle valve 2 in the 2nd operation gestalt the shape of the spherical surface, and the thing made into the shape of a cone are shown in drawing 5 and drawing 6, respectively. If it is made this appearance, dead volume will become small and precision will improve further.

[0017]
[Effect of the Invention] According to this invention, at the inlet port of a nozzle hole, a fuel becomes easy to exfoliate, the liquid column of a fuel and the self-excited vibration of liquid membrane are promoted, and the atomization of a fuel improves, consequently combustion becomes good, and the improvement in an output or reduction of exhaust gas emission can be obtained.

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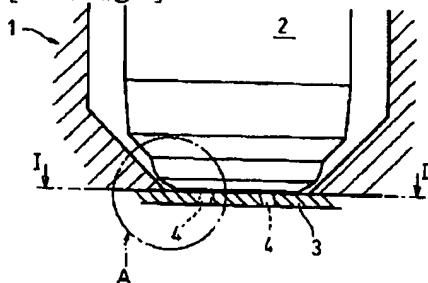
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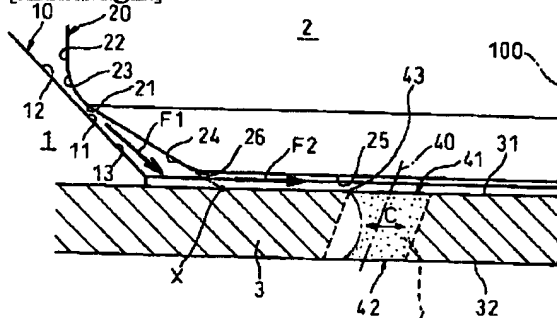
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DRAWINGS

[Drawing 1]

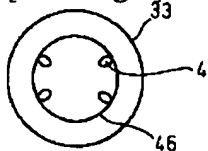


[Drawing 2]



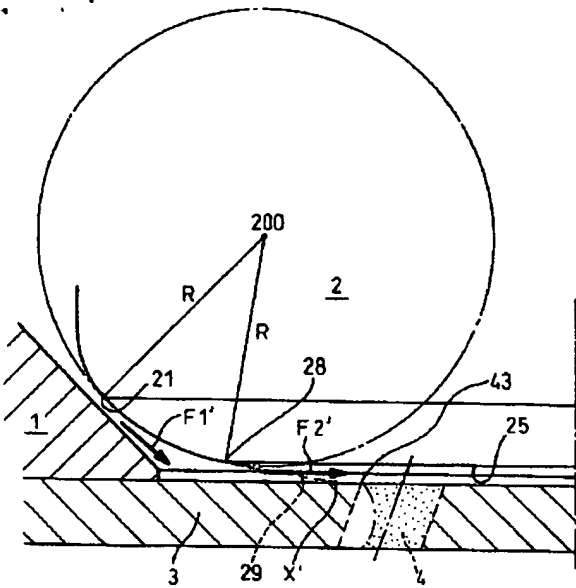
- 1 ...バルブボデー
2 ...ニードルバルブ
3 ...計量部材
4 ...噴孔

[Drawing 3]

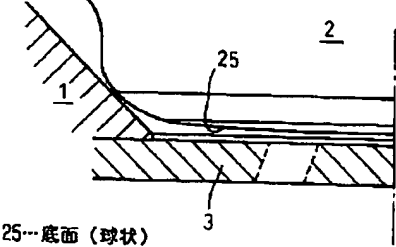


[Drawing 4]

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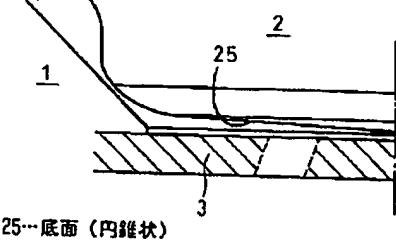


[Drawing 5]



25…底面（球状）

[Drawing 6]



25…底面（円錐状）

[Translation done.]